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FORM PTO-1390 (REV. 5-93)	U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEY'S DOCKET NUMBER ASA-1069
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US)		U S APPLICATION NO. *(if known, see 37 CFR 1.5)* 10/069580
International Application No. PCT/JP00/01574	International Filing Date March 15, 2000	Priority Date Claimed

Title of Invention: AUTOMATIC ANALYZER AND PART FEEDING DEVICE USED FOR THE ANALYZER

Applicant(s) for DO/EO/US: H. SUGIYAMA et al (see attached)

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [X] This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.
2. [ ] This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.
3. [X] This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. [X] A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. [X] A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. [ ] is transmitted herewith (required only if not transmitted by the International Bureau).
   b. [X] has been transmitted by the International Bureau.
   c. [ ] is not required, as the application was filed in the United States Receiving Office (RO/US).
6. [X] A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. [ ] Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. [ ] are transmitted herewith (required only if not transmitted by the International Bureau).
   b. [ ] have been transmitted by the International Bureau.
   c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [ ] have not been made and will not be made.
8. [ ] A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. [ ] An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. [ ] A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. [X] An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. [ ] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. [ ] A FIRST preliminary amendment.
    [ ] A SECOND or SUBSEQUENT preliminary amendment.
14. [ ] A substitute specification.
15. [ ] A change of power of attorney and/or address letter.
16. [X] Other items or information:

[X] LIST OF INVENTORS' NAMES AND ADDRESSES.

[X] THIS APPLICATION IS BEING FILED WITHOUT AN EXECUTED DECLARATION, WHICH WILL BE FILED LATER.

U.S. Application No (if known, see 37 CFR 1 5)	International Application No	Attorney's Docket Number
10/069580	PCT/JP00/01574	ASA-1069

17. [X] The following fees are submitted:	CALCULATIONS	PTO USE ONLY
Basic National Fee (37 CFR 1.492 (a)(1)-(5)):		
Search Report has been prepared by the EPO or JPO $890.00		
International preliminary examination fee paid to USPTO (37 CFR 1.482) $710.00		
No international preliminary examination fee (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445 (A)(2)) $740.00		
Neither international examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(A)(2)) paid to USPTO $1040.00		
International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2) to (4) $100.00		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 890.00	
Surcharge of $130.00 for furnishing the oath or declaration later than [X] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492(e)). +	$ 130.00	

Claims	Number Filed		Number Extra	Rate		
Total	16	-20 =	0	x $18.00	$ 0.00	
Independent	4	- 3 =	1	x $84.00	$ 84.00	
Multiple dependent claim(s) (if applicable)				+ $280.00	$ 0.00	
TOTAL OF ABOVE CALCULATIONS =					$ 1,104.00	
Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 CFR 1.9, 1.27, 1.28).					$ 0.00	
SUBTOTAL =					$ 1,104.00	
Processing fee of $130.00 for furnishing the English translation later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +					$ 0.00	
TOTAL NATIONAL FEE =					$ 1,104.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). $40.00 per property. +					$ 0.00	
TOTAL FEES ENCLOSED =					$ 1,104.00	
					Amount to be: Refunded	$
					Charged	$

a. [X] **A check in the amount of $** 1,104.00 **to cover the above fees is enclosed.**

b. [ ] **Please charge my Deposit Account No. 50-1417 in the amount of $** _____ **to cover the above fees. A duplicate copy of this sheet is enclosed.**

c. [X] **The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 50-1417. A duplicate copy of this sheet is enclosed.**

Note: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

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ASA-1069
W0125-01MD

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Title of the Invention

AUTOMATIC ANALYZER AND PART FEEDING DEVICE USED FOR THE ANALYZER

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14/prts

DESCRIPTION

AUTOMATIC ANALYZER AND PART FEEDING DEVICE USED FOR THE ANALYZER

TECHNICAL FIELD

The present invention relates to an automatic analyzer using disposable parts used in contact with samples, and a part feeding device for use in the analyzer.

BACKGROUND ART

By treating and measuring living samples such as blood plasma, serum, or urine using various reagents, measured information is obtained which is beneficial for various types of analysis items such as biochemical, immunological, or genetic analysis items. Then, if contamination between the samples must be severely prevented as in the case with the immunological or genetic analysis items, disposable nozzles tips are used. Further, for the same reason, disposable reaction containers may be used to mix the samples and reagents together. By using disposable parts as the nozzle tips and reaction containers, which are brought into contact with the samples, the contamination between the samples or inappropriate inspection data resulting from carryover is reduced.

JP-A-8-146010 specification describes an

automatic analyzer using disposable nozzle tips and reaction containers. With this conventional technique, tip racks have a large number of nozzle tips two-dimensionally arranged therein, and vessel racks have a large number of reaction containers two-dimensionally arranged therein. These part racks are so configured to be simply placed in a rack field, and a transportation device takes out nozzle tips or reaction containers from the corresponding rack one by one.

JP-A-8-94637 specification describes a biochemical analyzer comprising an automatic transportation device that transports tip racks in a horizontal direction to a nozzle tip install position and transports used tip racks to a waste preparatory position and then transports the used tip racks to a rack waste position.

JP-A-9-33541 specification describes a tip tray loading device that places a plurality of tip trays in a chute from its top, pulls out the tip trays from the bottom of the chute one by one, transports the pulled-out tip tray to the position of a probe of the automatic analyzer, connects each nozzle tip nozzle to the probe for use, and returns the empty tip tray from which the tips have been consumed, to the bottom of the chute, where the tip trays are dropped and wasted.

DISCLOSURE OF THE INVENTION

With the analyzer described in JP-A-8-146010

specification, it is difficult to automatically sequentially feed disposable parts (nozzle tips and/or reaction containers) required in large quantities, thereby requiring operators to set new tip and vessel racks in a given area and to remove used empty racks from the area. Consequently, this configuration involves temporal restrictions and leaves much room for improvement.

In contrast, the analyzer described in JP-A-8-94637 specification enables a certain level of automation but requires a large space in order to two-dimensionally transport a large number of tip racks. As a result, this analyzer must be generally large in size.

The analyzer described in one more JP-A-9-33541 specification can automatically feed a large number of nozzle tips. However, the operation of separating one tip tray from the others at the bottom of the chute is complicated, so that a take-put trouble is prone to occur in which the tip trays are inappropriately taken out from the chute. Further, since used tip trays are separately dropped and wasted, waste containers must be large in size. Furthermore, the analyzer described in JP-A-9-33541 specification takes out new tip trays only after used tips have been wasted, and thus operates inefficiently. The analyzer described in JP-A-9-33541 specification further requires the tip tray feeding chute to be arranged

higher than the position at which each nozzle tip is connected to the probe. Consequently, when the operators performs a certain operation on a sample feeding part, reagent feeding part, or reaction part of the analyzer, the presence of the chute may obstruct the operation.

It is an object of the present invention to provide an automatic analyzer and a part feeding device in which a compact system configuration can be used to feed unused parts to be contacted with samples and to recover part racks from which the parts have been consumed.

It is another object of the present invention to provide an automatic analyzer and a part feeding device which can feed a large number of part racks holding unused parts, while keeping them stacked together, and which can simply separate and take out only the uppermost part rack from the other stacked part racks.

The present invention is applied to an automatic analyzer that analyzes samples using disposable parts used in contact with the samples and changed to new ones for each sample.

A concept based on the present invention is characterized by comprising a lift that raises a plurality of part racks holding unused disposable parts, from the bottom of the analyzer to a rack separation station, located above, while keeping the

part racks stacked together, a rack separator that hinders the uppermost one of the plurality of stacked part racks from being lowered when the lift lowers, while allowing the other part racks to lower, so that the uppermost rack is separated from the other part racks so as to remain in the rack separation station, and a rack recovering part that operates after the parts on the separated part rack have been consumed, to move this empty part rack downward for recovery.

In a desirable embodiment to which the present invention has been applied, each fed part rack holds a plurality of disposable nozzle tips and disposable reaction containers. Further, the rack separator has a pair of hindering members that hinder the uppermost part rack from lowering. The pair of hindering members operate so that their interval increases when the uppermost part rack is raised to the rack separation station and decreases after the uppermost part rack has passed by the position of the pair of hindering members and before the second part rack from the top passes by the position of the pair of hindering members, thereby separating the uppermost part rack from the second part rack.

In the desirable embodiment of the present invention, a part rack taken out from the rack separation station and then moved to a part take-out station is pressed by a rack positioning device at a plurality of points thereof so as to rest at a

predetermined position. Then, a part take-out device takes out disposable parts from the thus positioned part rack one by one. In this case, the part rack has positioning recesses formed at a pair of opposite upper edges thereof, and the rack positioning device comprises members that abut against the positioning recesses.

A part feeding device based on the present invention comprises a supply lifter having a lift that can move a plurality of part racks while keeping them stacked together, the part racks each holding a plurality of disposable parts used to handle samples, the lift being raised to a rack separation station when the rack separation station can receive new part racks, a rack separator that takes out the uppermost one of the stacked part racks from the rack separation station so as to separate the uppermost part rack from the other part racks, a rack feeding device that moves the separated part rack in a horizontal direction from the rack separation station to a part take-out station, and a recovery lifter having a lift that receives the part rack from which the parts have been consumed while the part rack is on the part take-out station, at a position higher than the lowest position after part consumption.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic plan view showing an

entire configuration of an automatic analyzer as an embodiment to which the present invention has been applied;

FIG. 2 is a schematic plan view illustrating the vicinity of a part feeding device of the automatic analyzer in FIG. 1;

FIG. 3 is a side view of the interior of a rack lift chamber of the part feeding device in FIG. 2;

FIG. 4 is a partial perspective view of the vicinity of the rack lift chamber in FIG. 2;

FIG. 5 is a side view showing a supply and recovery rack lifters as viewed from a rear side of FIG. 3;

FIG. 6 is a perspective view showing that a plurality of part racks are placed on a receiving member of the lifter;

FIG. 7 is a sectional view taken along a line 1-1 in FIG. 6;

FIG. 8 is a perspective view illustrating functions of a rack separating mechanism of the part feeding device;

FIG. 9 is a sectional view illustrating an operation of the rack separating mechanism performed when the supply lifter is raised;

FIG. 10 is a sectional view showing conditions of the rack separating mechanism observed when the supply lifter is at the highest position;

FIG. 11 is a sectional view showing

conditions of the rack separating mechanism observed when the supply lifter lowers while leaving the uppermost part rack;

FIG. 12 is a partial perspective view illustrating that a part rack separated from the other part racks is moved to a part take-out station;

FIG. 13 is a partial perspective view illustrating an operation of a rack positioning mechanism and a floor part opening and closing mechanism both installed in a part feeding device;

FIG. 14 is a schematic perspective view illustrating how a part rack is pressed by the rack positioning mechanism; and

FIG. 15 is a sectional view taken along a line 2-2 in FIG. 14.

BEST MODE FOR CARRYING OUT THE INVENTION

An embodiment to which the present invention has been applied will be described with reference to the drawings. An automatic analyzer as a preferred embodiment analyzes samples using disposable parts used in contact with the samples and changed for each sample. In this example, the disposable parts include nozzle tips and reaction containers, but it is not always necessary to use both types of parts. One of these types may solely be used, or disposal parts other than the nozzle tips and reaction containers may be used. In either way, the disposable parts are two-

dimensionally held on part racks, and the part racks are set on a lift so as to be stacked together and supplied.

A part feeding device 80 incorporated in an automatic analyzer 100 in FIG. 1 comprises a rack separation station A and a part take-out station B in an area which is open to the exterior and which is at the highest position. As described later, a feeding lift 83 for unused part racks is arranged below the part take-out station A, and a recovering lift 84 for used part racks is arranged below the part take-out station B. The automatic analyzer 100 analyzes and measures living samples such as blood plasma, serum, or urine.

Each constituting mechanism part of the automatic analyzer 100 in FIG. 1 has their operations controlled by a controller 90. The automatic analyzer 100 comprises a subject carrier conveying system having a subject loader 48, a subject conveyance line 49, and a subject stocker 50, an analysis and measurement system having a reaction disk 54, a reagent disk 53, and a measuring part 57, and a disposable part handling system having the part feeding device 80 and a part transporting device 70. Samples to be analyzed and measured are accommodated in a sample container 60, and a box-shaped subject carrier 47 has a plurality of sample containers 60 loaded therein. Preferably, one subject carrier 47 has five or ten sample containers

held therein. Information on the samples in the sample container 60 and information on requested analysis items are input beforehand through an input part of the controller. The analysis conditions for each analysis item are stored in the controller 90.

Each sample container 60 has a subject identification information medium such as a bar code provided on an outer wall thereof, and each subject carrier 47 has a carrier identification information medium such as a bar code provided thereon. The subject carrier 47 with subject containers loaded therein is set in the subject loader 48 by an operator. The subject loader 48 feeds the subject carrier 47 to the subject conveyance line step by step. Upon receiving the subject carrier 47, the subject conveyance line 49 coveys the subject carrier to a sample extraction position S. Before the subject carrier is transported to the sample extraction position, carrier identification information on each subject carrier and/or subject identification information on each sample container is read by an identification information reader (not shown) such as a bar code reader, and is then transmitted to the controller 90. On the basis of the read information, the controller 90 controls the operation of a subject sampling mechanism 51, the reagent disk 53, a reagent dispensing mechanism 52, the reaction disk 54, the measuring part 57, and others. The subject carrier 47,

subjected to a sample extracting process at the sample extraction position S, is transported through the subject conveyance line 49 to the subject stocker 50, where it is stored.

In the part handling system, the part feeding device 80 provides nozzle tips and reaction containers both used to avoid carryover or contamination between the samples. These disposable parts are moved through the part feeding device 80 while being two-dimensionally held on a part rack 12. The part transportation device 70 sets one of the disposable reaction containers as parts 13 arranged on the part rack 12 located on the part take-out station B, on the reaction disk 54, and then sets one of the disposable nozzle tips as parts arranged on the same part rack, on a tip installation position 58. A tip coupling nozzle of the subject sampling mechanism 51 couples to the nozzle tip at the tip installation position 58, and subsequently the subject sampling mechanism 51 performs a sample extraction operation.

The part transportation device 70 comprises a movable holding part 59 which can hold the nozzle tip or reaction container and which can slide along a guide bar 71. Further, the guide bar 71 can move along a rail extending in the direction orthogonal thereto. Thus, the holding part 59 can freely move in both X and Y directions two-dimensionally and in a vertical direction at a predetermined position. The subject

sampling mechanism 51 comprises a nozzle to which the nozzle tip is joined and a pump that is in communication with the nozzle. The subject sampling mechanism 51 functions as a pipetter.

When the subject carrier 47 is transported to the sample extraction position S, the nozzle of the subject sampling mechanism 51, to which the nozzle tip has already been connected, pivots to the sample extraction position, and a tip of the nozzle tip is inserted into the sample in the sample container 60 to suck a predetermined amount of sample in the nozzle tip. Then, the nozzle is raised and caused to pivot to the reaction disk 54, and then ejects the sample contained in the nozzle tip, into a disposable reaction container 13b located at a sample reception position D on the reaction disk 54. The nozzle, which has finished pipetting the sample, is caused to pivot to a part waste position 3, where the used nozzle tip is removed from the nozzle. Then, the nozzle tip is thrown away into a waste part recovery box through a hole formed at the part waste position 3, the waste part recovery box being arranged below the hole.

On the other hand, the reaction container 13b, which has received the sample at the sample reception position D, is rotationally moved to a reagent reception position R by the reaction disk 54. At this position, the reaction container 13b receives a reagent corresponding to an analysis item to start

reaction. The reagent disk 53 holds a plurality of reagent bottles 67 accommodating reagents corresponding to various types of analysis items, and sets a reagent bottle corresponding to the analysis item on the reaction disk 54, at a reagent suction position. The reagent pipetting mechanism 52 sucks a predetermined amount of reagent in the reagent bottle 67 using a pipet nozzle, and then ejects the reagent into the reaction container 13b on the reaction disk 54.

The mixture of the sample and reagent is allowed to react on the reaction disk 54 for a predetermined time, and the reaction container 13b, in which a reaction product has been formed, is moved to a reacted liquid suction position K by a rotating operation of the reaction disk 54. A reacted liquid sucker 56 has a suction nozzle connected to a flow cell of the measuring part 57 to suck the reacted liquid from the reaction container located at the reacted liquid suction position K to thereby introduce it into the flow cell. The measuring part 57 carries out measurements on the introduced reacted liquid using, for example, a photometer. The used reaction container 13b, into which the reacted liquid has been sucked, is moved to a predetermined position by rotation of the reaction disk 54. At this position, the reaction container 13b is held by the holding part 59 of the part transportation device 70, and then transported to the part waste position 3, where it is thrown away into

the waste part recovery box.

Now, the detailed configuration of the part feeding device 80 will be described with reference to FIGS. 2 to 7. The part feeding device 80 has the rack separation station A, the part take-out station B, and a rack waste station installed in an open area located at the upper end thereof. The part take-out station B may be aligned with the position of the rack separation station A or rack waste station, or may be arranged between the rack separation station A and the rack waste station. In the automatic analyzer in FIG. 1, the part take-put station B is aligned with the position of the rack waste station. In this desirable embodiment, the part take-out station B does not overlap the rack separation station, so that while the part transportation device 70 is continuing taking out parts from the current part rack on the part take-out station B, a new part rack 12 with unused part mounted thereon can be moved to the rack separation station A. Consequently, once all the parts on the current part rack have been consumed, the new part rack can be immediately fed to the rack take-out station B, thereby enabling an efficient part take-out operation.

As shown in the detailed configuration in FIGS. 3, 4, and 5, a supply lifter 14 is arranged below the rack separation station A, and a recovery lifter 15 is arranged below the part take-out station B. The lifts 14 and 15 are housed in a rack lift chamber 85 of

the part feeding device 80. Further, these lifts are mounted on a movable table 82. The rack lift chamber 85 has a door 17 installed at a front surface thereof and for which an electromagnetic lock is operated by the controller 90. Only when both the lift 83 of the supply lifter 14 and a lift 84 of the recovery lifter 15 are at their lowest positions (bottom dead centers), the electromagnetic lock can be cleared to open the door 17. Safety measures are provided such that while the lifts 14 and 15 are in operation or immediately before they start operations, the controller 90 automatically locks the door 17 to prevent the operator from loading a part rack in the rack lift chamber 85 or taking out an empty part rack from the rack lift chamber 85 while the lifts are in operation.

When the door 17 is opened, the lifts 14 and 15 can be pulled out from the rack lift chamber 85 toward its front surface side together with the movable table 85. The operator can then set a new part rack 12 on the feeding lift 83 and remove a used part rack from the recovering lift 84. The rack lift chamber 85 has two removable waste part recovery boxes 41a and 41b (FIG. 2) arranged inside the rack lift chamber 85 along a rear wall 6 so as to lie below the part waste position 3 in FIG. 1. When the pulled-out movable table 82 is pushed to a predetermined position, the lifts 14 and 15 are settled at their original positions where the lifts 83 and 84 can be raised and lowered.

As is apparent particularly from FIGS. 6 and 7, the part rack 12 is shaped like a box having a four trapezoidal sides, and is molded of plastics. Four side walls each have a lower edge larger than an upper edge and are thus inclined to widen downward so that part racks can be stacked together. A cavity is formed inside the side walls, and no bottom wall is installed at the bottom of the part rack. The top surface of the part rack 12 is generally rectangular and has holes two-dimensionally arranged thereon and in which a large number of disposable parts can be installed. In the example in FIG. 6, 14 x 12 holes are formed and each have a part inserted thereinto. A plurality of disposable nozzle tips 13a and a plurality of disposable reaction containers 13b can be installed on a single part rack 12. In the example in FIG. 6, a number of nozzle tips and the same number of reaction containers are held thereon.

The part rack 12 has protruding parts 65a and 65b formed at the lower ends of at least two opposite side walls and each having a predetermined width and length. The pair of protruding parts 65a and 65b abut against a lowering hindering member of a rack separator, described later, to facilitate separation of part racks. A thin rib 62 is formed vertically downward from a top face in the internal space of each part rack 12 enclosed by the side walls, so as not to obstruct insertion of parts. The rib 62 is formed like

a cross that crosses at the center of a single part rack. The depth-wise distance of the rib 62 is half or less of the height of the part rack. The presence of the rib 62 serves to maintain a fixed interval between the top surfaces of part racks even when they are stacked together, thereby forming a small gap between the side walls of stacked part racks. Consequently, the upper part rack can be separated from the lower part rack.

As is apparent from FIGS. 3, 5, 6, and 7, the supply lifter 14 and the recovery lifter 15 have similar structures. The lift 83 of the supply lifter 14 has a receiving member 19a mounted thereon and having an outward form similar to that of the part rack 12. The lift 84 of the recovery lifter 15 has a receiving member 19b mounted thereon and having the same shape. These receiving members are each shaped like a box having a lower end larger than an upper end so that when the part rack 12 is placed on the receiving member from above so as to cover it, the rack 12 fits the receiving member. These receiving members can each move into the part rack. Simply by placing the part rack 12 holding unused parts, on the receiving member 19a, this part rack can be precisely positioned so as not to incline even when other part racks are staked thereon. Further, the receiving member 19b of the recovering lift 84 can maintain the positions of part racks so that the part racks will not

significantly deviate from their regular positions (where the top surfaces of the part racks are level) upon receiving an empty part rack.

The rack lift chamber 85 comprises a rack feeding part having the supply lifter 14, and a rack recovering part having the recovery lifter 15. A guide wall 18 of the rack feeding part forms a generally vertical lift path to maintain the longitudinal and transverse directions of a plurality of part racks 12 holding unused parts so as to prevent the racks from collapsing when the lift 83 is raised and lowered with the part racks stacked together. A guide wall 35 of the rack recovering part forms a generally vertical lift path to maintain the longitudinal and transverse directions of a plurality of stacked part racks so as to prevent the racks from collapsing when the lift 84 is raised and lowered after receiving a plurality of empty part racks while keeping them stacked together, from which the parts have been consumed. Consequently, the feeding and recovering lifts 83 and 84 are raised and lowered through a limited space via the guide walls, which are arranged to fit the size of the part rack 12.

The movable table 82 has the supply lifter 14 and the recovery lifter 15 mounted thereon, and the lift 83 of the supply lifter 14 is driven by a pulse motor 20. A timing belt 22 is extended in the vertical direction between a lower pulley 21a and an upper

pulley 21b. Rotational force from the pulse motor 20 is transmitted via the pulleys and timing belt to the lift 83, which is attached to the timing belt 22, so that the lift 83 is moved in the vertical direction. The lift 84 of the recovery lifter 15 is driven by a pulse motor 37. A timing belt 39 is extended in the vertical direction between a lower pulley 38a and an upper pulley 38b. Rotational force from the pulse motor is transmitted to the lift 84, which is attached to the timing belt 39, so that the lift 84 is moved in the vertical direction. The rack feeding part has a position sensor 24 arranged at the bottom thereof for detecting the lowest position (bottom dead center) of the lift 83. Further, the rack recovering part has a position sensor 36 arranged at the bottom thereof for detecting the lowest position (bottom dead center) of the lift 84.

Near the rack separation station A, located at the top of the rack feeding part, are arranged an uppermost position sensor 7 for detecting the uppermost one 12a of the stacked part racks when it is separated from the other part racks and a second position sensor 28 for detecting the second part rack 12b during a rack separating operation. At a height close to the part take-out station B, located at the top of the rack recovering part, are arranged a fall detecting sensor 16 for detecting the part rack 12 falling from the part take-out station B and an uppermost position sensor 40

for adjusting the height of the uppermost one of a plurality of stacked part racks when the recovering lift 84 is to receive an empty rack.

The part feeding device 80 comprises a rack separator 8 that separates and holds only the uppermost one of a plurality of stacked part racks in the state separated from other part racks so as to leave it in the rack separation station, the plurality of part racks having been raised to the rack separation station from the lowest position by the lift 83 of the supply lifter 14, a set position; a rack transferring device 95 that moves the uppermost part rack separated from the other part racks by lowering the lift 83 in the direction of the part take-out station B from the rack separation station; a rack positioning device 75 that positions the part rack delivered to the part take-out station B by pressing the part rack at a plurality of points thereof to settle it at a predetermined position; a floor-part opening and closing device 11 that opens the floor part (an openable and closable member) on which the part rack is placed at the part take-out station B when the lift 84 of the recovery lifter receives the part rack from the part take-out station, the floor-part opening and closing device subsequently closing the floor part; and other components.

The operator pulls out the movable table 82 to the front surface of the part feeding device, places

a plurality of part racks holding unused disposable parts (in this example, nozzle tips and reaction containers) so as to stack together, on the feeding lift 83, and then closes the door 17. If the rack separation table A is ready to receive a new part rack, the lift 83 is raised to the rack separation table A. The uppermost part rack 12a of the stacked part racks is sensed by the uppermost position sensor 7 when it reaches the rack separation station, and on the basis of this detection, the rack separation device 8 holds the uppermost part rack 12a so as to hinder it from falling from the rack separation station. When the lift 83 lowers from the rack separation station, the rack separator 8 hinders the uppermost part rack 12a from falling, while allowing the other part racks including the part rack 12b, which has been located at the second position in the initial stack state, thereby leaving the uppermost part rack 12a on the rack separation station. After the separating operation, the lift 83 is lowered to the lowest position.

During the descent of the lift 83, the part rack 12b, which has been located at the second position from the top in the initial stack state (the uppermost position during the descent), is sensed by the second position sensor 28. On the basis of sensed information from the uppermost position sensor 7 and second position sensor 28, the control part 90 determines whether or not the uppermost part rack 12a has been

properly separated in order to determine whether to continue the operation of the part feeding device 80 or interrupting the operation and alarming the operator. The part transporting device 70 takes out disposable parts from the part rack on the part take-out station B one by one. During this time, the floor-part opening and closing device 11 closes the opening and closing member so that the part rack is fixed to the part take-out station B. Once all the disposable parts on the part rack on the part take-out station have been consumed, the floor-part opening and closing device 11 opens the opening and closing member to drop the part rack downward so that this used empty part rack can be received on the recovering lift 84. Thus, this part rack is recovered so that a plurality of empty part racks are stacked together on the lift 84. The lift 84 is raised to a position closer to the part take-out station than to the lowest position before receiving the part rack. Accordingly, the distance that the part rack must fall before reaching the lift 84 is reduced to ensure recovery, and possible noise produced during the fall is reduced. After receiving the part rack, the lift 84 is lowered to the lowest position.

According to this embodiment, unused disposable parts contacted with samples when used in the automatic analyzer can be fed upward while being held on a part rack, and an empty rack from which the parts have been consumed can be recovered by moving it

downward, thereby achieving a generally compact configuration. Further, a plurality of part racks holding unused parts are fed to the rack separation station while being stacked together on the feeding lift, and the uppermost one of the stacked part racks can be solely and easily separated from the other part racks and taken out. A plurality of used empty part racks can be recovered so as to be stacked together on the recovering lift, allowing the size of the rack recovering part to be reduced. Furthermore, the supply lifter and the recovery lifter can be arranged adjacent to each other so as to rise and lower parallel with each other, thereby allowing the part feeding device to be constructed with a reduced floor area.

Now, the rack separator for separating the uppermost part rack from the supply lifter will be described with reference to FIGS. 8, 9, and 10.

The rack separating mechanism 8 has a pair of hook bars 26a and 26b separated so as to leave a space therebetween the size of which matches the width of the part rack. The transversally long hook bars 26a and 26b are attached to rotating shafts 25a and 25b in such a manner that their transversally long directions are parallel. The transversally long hook bars 26a and 26b are formed of relatively thin metal (for example, stainless steel) and are thus somewhat elastic. The hook bars 26a and 26b have shell parts 68a and 68b, respectively, formed in the vertical middle thereof and

on which the protruding parts 65a and 65b of the part rack 12 can be laid. The hook bars 26a and 26b have their sides pressed by torsion springs 27a and 27b, respectively, attached to the rotating shafts 25a and 25b, respectively. The springs 27a and 27b may pull the lower ends of the hook bars 26a and 26b, respectively, as shown in FIG. 8. The essential point is that the shelf parts 68a and 68b of the hook bars normally undergo such rotational force that the shelf parts are closed in the direction (inward) in which they approach each other.

The hook bars 26a and 26b have their upper ends abutted against stoppers 61a and 61b, respectively, which restricts rotation of the hook bars so as to prevent them from being closed beyond their predetermined positions. While the hook bars 26a and 26b are abutting against the stoppers 61a and 61b, respectively (normal state), the distance between the pair of shelf parts 68a and 68b is smaller than that between the tips of the pair of protruding parts 65a and 65b of the part rack 12 and larger than the width of the part rack 12 excluding the protruding parts 65a and 65b.

The rack separation station A can receive a part rack when it has no part racks. In this case, the upper ends of the hook bars 26a and 26b abut against the stoppers 61a and 61b, respectively. A plurality of part racks 12 holding unused disposable parts 13a and

13b are raised by the feeding lift 83 while being stacked together. When the uppermost stacked part rack 12a is raised and passes between the pair of hook bars 26a and 26b, the protruding parts 65a and 65b, abutted against the sides of the hook bars 26a and 26b, respectively, push open the hook bars 26a and 26b, respectively, as the part rack is raised. That is, the force applied by the supply lifter 14 to raise the part rack 12a pushes open the hook bars 26a and 26b outward against the force of the springs 27a and 27b, which operate to reduce the distance between the hook bars. This is shown in FIG. 9.

When the uppermost part rack 12a is further raised, the protruding parts 65a and 65b of the part rack 12a pass by the shelf parts 68a and 68b of the hook bars 26a and 26b, respectively, thereby narrowing the hook bars 26a and 26b due to the spring force. Consequently, the interval between the shelf parts 68a and 68b becomes smaller than the interval between the protruding parts 65a and 65b. This is shown in FIG. 10. At this timing, the uppermost position sensor 7 senses the uppermost part rack 12a and transmits a sensor signal to the controller 90. On the basis of this sensor signal, the controller 90 controls the supply lifter 14 to stop lifting. In this case, the protruding parts of the second part rack 12b from the top are kept in the state present before they come into contact with the hook bars 26a and 26b. Accordingly,

the hook bars 26a and 26b remain closed.

Then, the feeding lift 83 starts a lowering operation. At this time, the shelf parts 68a and 68b of the hook bars 26a and 26b acts as a pair of hindering members for hindering the part rack 12a, located at the uppermost position during the ascent, from lowering. That is, the part racks 12b, 12c, ..., located at the second and subsequent positions during the ascent, lower due to their weights in such a manner as to follow the lowering operation of the lift 83. However, the part rack 12a, located at the uppermost position during the ascent, is not lowered because the shelf parts 68a and 68b of the hook bard 26a and 26b are narrowed to keep the protruding parts 65a and 65b sitting on the shelf parts 68a and 68b. This allows the uppermost part rack to be separated from the other part racks.

Once the lift 83 starts lowering, the second position sensor 28, arranged in the vicinity of the hook bars 26a and 26b for monitoring a position slightly lower than the lower end of the uppermost part rack 12a, determines whether or not the part rack 12a, located at the uppermost position during the ascent, is present. If the rack separation has been normally executed, the second position sensor does not sense the part rack. However, if the uppermost part rack 12a has lowered with the other part racks rather than being held by the rack separating mechanism 8, the second

position sensor senses its presence. On the basis of sensor signals from the uppermost position sensor 7 and the second position sensor 28, the controller 90 judges whether or not the uppermost part rack 12a has been normally separated from the other part racks.

Subsequently, the lift 83 lowers to the lowest position (bottom dead center). At this time, if the uppermost part rack 12a has been normally separated from the other part racks, the part feeding device 80 continues to perform subsequent operations. However, if the uppermost part rack 12a has not been normally separated from the other part racks, the controller 90 stops the part feeding device 80 from performing subsequent operations, and causes a buzzer 45 such as the one shown in FIG. 2 to produce a warning sound and/or causes a display 44 such as a CRT to provide alarm information, thereby warning the operator.

Further, the controller 90 receives a signal from the position sensor 24 for detecting the lowest position, counts the number of pulses transmitted to the pulse motor 20 in order to lower the lift 83 from the highest position to the lowest position, calculates the number of part racks 12 remaining on the feeding lift 83 on the basis of the number of pulses, and shows, on the display 44, the number of remaining part racks and the number of part racks that can be added to the lift 83. In this case, at the same time, the number of disposable parts remaining on the lift 83 may

be calculated and shown on the display 44. Furthermore, if the number of part racks remaining on the lift 83 is smaller than a threshold preset in the controller 90, the controller 90 uses the buzzer 45 and the display 44 to warn the operator to urge him or her to add unused part racks to the lift 83. If both the lifts 83 and 84 are at the lowest positions, even when the part take-out station B is taking out parts, new part racks can be added to the feeding lift 83, while used part racks can be removed from the recovering lift 84.

The part rack 12a, separated from the other part racks 12b and 12c on the rack separation station A, is moved from the rack separation station A to the rack take-out station B by the rack feeding mechanism 95, shown in FIG. 2. The configuration of the rack feeding mechanism 95 will be described with reference to FIGS. 2 and 12.

The rack feeding mechanism 95 comprises the timing belt 5 installed so as to be rotationally moved between the rotating shaft of the pulse motor 4 and the pulley 10. The timing belt 5 has a shift lever 9 attached thereto. A driving operation performed by the pulse motor 4 causes the shift lever 9 to reciprocate between a standby position (see FIG. 12) located at the leading position of the rack separation station A and a position at which it is pushed out to the part take-out station (see FIG. 2). The part rack separated from the

other part racks on the rack separation station A is positioned on the part take-out station B by causing the shift lever 9 to push the rear side of this part rack. The shift lever 9, which has pushed out the part rack 12a in the horizontal direction, returns to the original standby position before the new part rack 12b is fed to the rack separation station A. At this position, the shift lever 9 stands by so that the next part rack can be fed.

A position sensor 43 senses that the shift lever 9 has reached the proper push-out position, and a position sensor 47 senses that the shift lever 9 has returned to the original standby position. As shown in FIGS. 12 and 13, the part rack 12a, which has reached the part take-out station B, is positioned by bearings 30a, 30b, and 30c as part rack pressing members of the rack positioning mechanism 75 so as to be properly fixed in all of the longitudinal, transversal, and vertical directions.

The rack positioning mechanism 75, arranged correspondingly to the part take-out station B, comprises two arms 29a and 29b formed of metal plates and arranged opposite each other. The larger arm 29a has the bearings 30b and 30c abutted against the part rack 12a and attached to the arm 29a at such an angle (for example, 45° relative to the horizontal) that pressure is exerted on the part rack 12a in both the vertical and horizontal directions. Additionally, the

smaller arm 29b has the bearing 30a similarly attached thereto at such an angle (for example, 45°) that pressure is exerted on the part rack 12a in both the vertical and horizontal directions. These bearings are located correspondingly to a plurality of positioning recesses 46a, 46b, and 46c formed on parallel and opposite upper edges of the part rack 12 as shown in FIG. 14. When the part rack 12a is fixed in position, it is abutted so that each bearing is fitted in the corresponding recess.

The rack positioning mechanism 75 is operated in connection with the floor-part opening and closing mechanism 11 (FIG. 13). As shown in FIGS. 12 and 13, the floor part of the part take-out station B, on which part racks are placed, is composed of a pair of movable plates 34a and 34b that can be opened and closed in the horizontal direction. These movable plates constitute part of the floor-part opening and closing mechanism 11. The arm 29a of the rack positioning mechanism 75 is attached to the movable plate 34a, and the other arm 29b is attached to the movable plate 34b. The movable plate 34a is fixed to a slider 77a, and the other movable plate 34b is fixed to a slider 77b. The arms 29a and 29b in FIG. 13 have shapes slightly different from those shown in FIG. 12, but have the same functions as the arms in FIG. 12.

The sliders 77a and 77b can slide along a slide shaft 76. As the sliders slide, the pair of

movable plates 34a and 34b change the interval therebetween while remaining parallel with each other, and function as a floor part when positioning a rack part or as a floor-part opening and closing member when recovering a part rack. The floor-part opening and closing mechanism 11 has a timing belt 31 extended between a pulley 32b attached to a rotating shaft of a pulse motor 33 and a pulley 32a located horizontally relative to the pulley 32b. The sliders 77a and 77b are set on the timing belt 31 so that as the timing belt 31, driven by the pulse motor, moves, the two sliders 77a and 77b approach or leave each other.

The floor-part opening and closing mechanism 11 opens and closes the movable plates 34a and 34b through three stages. The first stage corresponds to an open and close state of the movable plates 34a and 34b maintained when the part rack 12 is moved from the rack separation station A to the part take-out station B. At the first stage, as shown in FIG. 15, the arms 29a and 29b are half-opened so that the bearings 30a and 30b as rack pressing members will not contact with the transferred part rack 12. In this case, the interval between the two plates 34a and 34b is in an intermediate state in which the plates 34a and 34b can support the upper end (bottom) of the transferred part rack 12 so that the rack 12 will not fall. Before the part rack 12 is conveyed by the rack feeding mechanism 95, the movable plates 34a and 34b stand by while

remaining open in the intermediate state, which corresponds to the first stage.

The second stage corresponds to an open and close state of the movable plates 34a and 34b maintained when the part rack 12 that has reached the part take-out station B is precisely positioned so as to be correctly taken out by the movable holding part 59 of the part transporting device 70. At the second stage, the interval between the pair of movable plates 34a and 34b is kept smallest among the three stages. The second stage is carried out after the first stage; the interval between the movable plates 34a and 34b is reduced so as to press the plurality of bearings 30a, 30b, and 30c against the part rack 12 on the movable plates 34a and 34b. Thus, the interval between the pair of arms 29a and 29b is reduced to abut and fix the three bearings against and to the three corresponding recesses 46a, 46b, and 46c in the part rack 12, sandwiched between the arms 29a and 29b, thereby precisely positioning the part rack on the part take-out station B in all of the longitudinal, transversal, and vertical directions.

The pressing members 30a, 30b, and 30c may each have a cylindrical shape as shown in the figure, or a spherical shape or another similar shape. When the part rack 12 is fixed in position, the pressing members (bearings) are fitted in the corresponding recesses 46a, 46b, and 46c to correct the horizontal

position of the part rack. Further, since the direction of the pressing force of the pressing members inclines relative to a horizontal and vertical surfaces, partial force that presses the part rack 12 downward is generated to prevent the rack 12 from floating.

The third stage corresponds to an open and close state of the movable plates 34a and 34b maintained when the empty part rack 12 from which the parts 13 have been consumed is recovered from the part take-out station B and transferred to the lift 84 of the rack recovering part. At the third stage, the maximum interval is maintained between the pair of movable plates 34a and 34b. This maximum interval is larger than the distance between the opposite ends of the protruding parts 65a and 65b, so that the empty part rack 12 falls onto the lift 84 so as to stack up on already recovered empty racks, the lift 84 having been raised up to a position closer to the part take-out station B than to the lowest position.

Now, an operation performed by the rack recovering part to recover used part racks will be described with reference to FIGS. 3, 4, and 5. At the part take-out station B, the parts are consumed one by one, and when few parts remain on the part rack 12, the lift 84, which has been standing by at the lowest position, is raised to the part take-out station B. Then, when the uppermost position sensor 40 senses the

uppermost one of the used part racks already stacked together on the lift 84, the controller 90 stops raising the lift 84. In this case, even if no recovered empty racks are placed on the lift, the uppermost position sensor 40 senses the receiving member 19b, which is substantially as high as the part rack on the lift 84, to similarly stop the lift.

Once the disposable nozzle tips 13a and/or reaction containers 13b on the part rack 12 positioned on the part take-out station B have been used up, the controller 90 controls the operation of the pulse motor 33 of the floor-part opening and closing mechanism 11 to maximize the opening of the pair of movable plates 34b and 34b to drop the used part rack 12 onto the lift 84. That passage through which the part rack falls is limited by the guide wall 35 to fit the outward form of the part rack, so that the part rack falls a short distance while maintaining substantially the same position as that it assumed on the part take-out station, and then sits on the already recovered other part racks or the receiving member 19b. The part rack falls from the part take-out station B to the uppermost position sensor 40. This short falling distance serves to make possible noise low during the fall and to prevent the part rack from being damaged. Further, the part rack can be reliably staked up on the other part racks while maintaining its position.

When the fall detecting sensor 16, arranged

in the fall passage, senses that the part rack 12 has fallen, the controller 90 realizes that the part rack has been normally recovered, and lowers the lift 84 down to the lowest position. When the fall detecting sensor 16 does not sense the part rack, the controller 90 lowers the lift 84 down to the lowest position, while determining that an error has occurred during the receiving operation to output a warning notifying the operator of the error, using the buzzer 45 and/or display 44.

When the position sensor 36 detecting the lowest position senses the lift 84, the table 84 is stopped, and on the basis of the number of pulses supplied to the pulse motor 37 and required for this fall, the controller 90 calculates the number of part racks recovered and placed on the lift 84. When the calculated number reaches a preset threshold, the controller 90 outputs a warning using the buzzer 44 and/or display 44 to urge the operator to take out the recovered part racks from the rack recovering part. This configuration enables up to a predetermined number of the used part racks to be recovered in order while being stacked together on the lift, thereby reducing the required volume of the recovering part. Further, the supply lifter 14 is arranged by the side of the recovery lifter 15 to feed unused part racks with unused disposable parts mounted thereon, thereby reducing the required floor area of the part feeding

device 80.

CLAIMS

1. An automatic analyzer that analyzes samples using disposable parts used in contact with the samples and changed for each sample, characterized by comprising:

a lift that raises a plurality of part racks holding unused disposable parts to a rack separation station, while keeping the part racks stacked together;

a rack separator that hinders the uppermost one of said stacked part racks from being lowered when said lift lowers, while allowing the other part racks to lower, so that said uppermost rack is separated from said other part racks so as to remain in said rack separation station; and

a rack recovering part that operates after the parts on the separated part rack have been consumed, to move this used part rack downward for recovery.

2. The automatic analyzer according to Claim 1, characterized in that said part rack holds a plurality of disposable nozzle tips and disposable reaction containers.

3. The automatic analyzer according to Claim 1, characterized in that said part rack is shaped like a trapezoid having a lower edge larger than an upper edge, and said part rack has protruding parts formed on at least two opposed side walls and which can abut against fall hindering members of said rack separator.

4. The automatic analyzer according to Claim 1, characterized in that said lift is housed in a rack lift chamber having a part introducing door locked while said lift is in operation.

5. The automatic analyzer according to Claim 1, characterized in that said rack separator has a pair of hindering members that hinder the uppermost part rack from lowering, and the pair of hindering members operate so that their interval increases when said uppermost part rack is raised to said rack separation station and decreases after said uppermost part rack has passed by the position of the pair of hindering members and before the second part rack from the top passes by the position of said pair of hindering members.

6. The automatic analyzer according to Claim 1, characterized in that said lift comprises a lift having a rack receiver formed thereon and which can move into said part rack.

7. The automatic analyzer according to Claim 1, characterized in that a first rack position sensor that senses the uppermost one of the stacked part racks and a second rack position sensor that senses the second part rack from the top of the stacked part racks are arranged in the vicinity of said rack separation station, and the analyzer comprises a control part that determines whether or not said uppermost part rack has been properly separated from the other part racks on

the basis of sensed information from said first and second rack position sensor.

8. An automatic analyzer that analyzes samples using disposable parts used in contact with the samples and changed for each sample, characterized by comprising:

a lift that raises a plurality of part racks holding unused disposable parts to a rack separation station, while keeping the part racks stacked together;

a rack separator that holds the uppermost one of the stacked part racks so as to leave it on said rack separation station;

a rack positioning device that presses the part rack taken out from said rack separation station and then moved to a part take-out station, at a plurality of points thereof so that the part rack rests at a predetermined position; and

a part take-out device that takes out disposable parts from the said positioned part rack.

9. The automatic analyzer according to Claim 8, characterized in that said part rack has positioning recesses formed at a pair of opposite upper edges thereof, and said rack positioning device comprises members that abut against said positioning recesses.

10. A part feeding device, characterized by comprising:

a supply lifter having a lift that can move a plurality of part racks while keeping them stacked

together, the part racks each holding a plurality of disposable parts used to handle samples, the lift being raised to a rack separation station when the rack separation station can receive a new part rack;

a rack separator that takes out the uppermost one of the stacked part racks from said rack separation station so as to separate the uppermost part rack from the other part racks;

a rack feeding device that moves the separated part rack in a horizontal direction from said rack separation station to a part take-out station; and

a recovery lifter having a lift that receives the part rack from which the parts have been consumed while the part rack is on said part take-out station, at a position higher than the lowest position after part consumption.

11. The part feeding device according to Claim 10, characterized in that the lift of said recovery lifter has a rack receiver that can move into the part rack from which the parts have been consumed, in order to receive the part rack.

12. The part feeding device according to Claim 11, characterized in that after receiving the part rack from which the parts have been consumed, at the position higher than said lowest position after part consumption, the lift of said recovery lifter lowers down to said lowest position.

13. The part feeding device according to Claim

10, characterized in that the lift of said recovery lifter is raised and lowered through a space limited by a guide wall arranged to fit the size of said part rack.

14. The part feeding device according to Claim 10, characterized in that said part take-out station is arranged on an extension of a direction in which the lift of said recovery lifter is raised, and the part rack on said part take-out station is placed on an openable and closable member that is opened when the lift of said recovery lifter receives the part rack.

15. An automatic analyzer that analyzes samples by taking out a disposable nozzle tip from a part rack located on a part take-out station and pipetting a sample from a sample container in the taken-put nozzle tip to a reaction container, characterized by comprising:

a lift that raises a lift on which a plurality of part racks holding unused disposable nozzle tips are stacked together;

a sensor that senses that the uppermost one of the plurality of part racks raised by said lift has reached a rack separation station;

a rack separating device that holds and hinders said uppermost part rack from falling from said rack separation station on the basis of the sensing of said uppermost part rack by the sensor; and

a rack transferring device that transfers, by

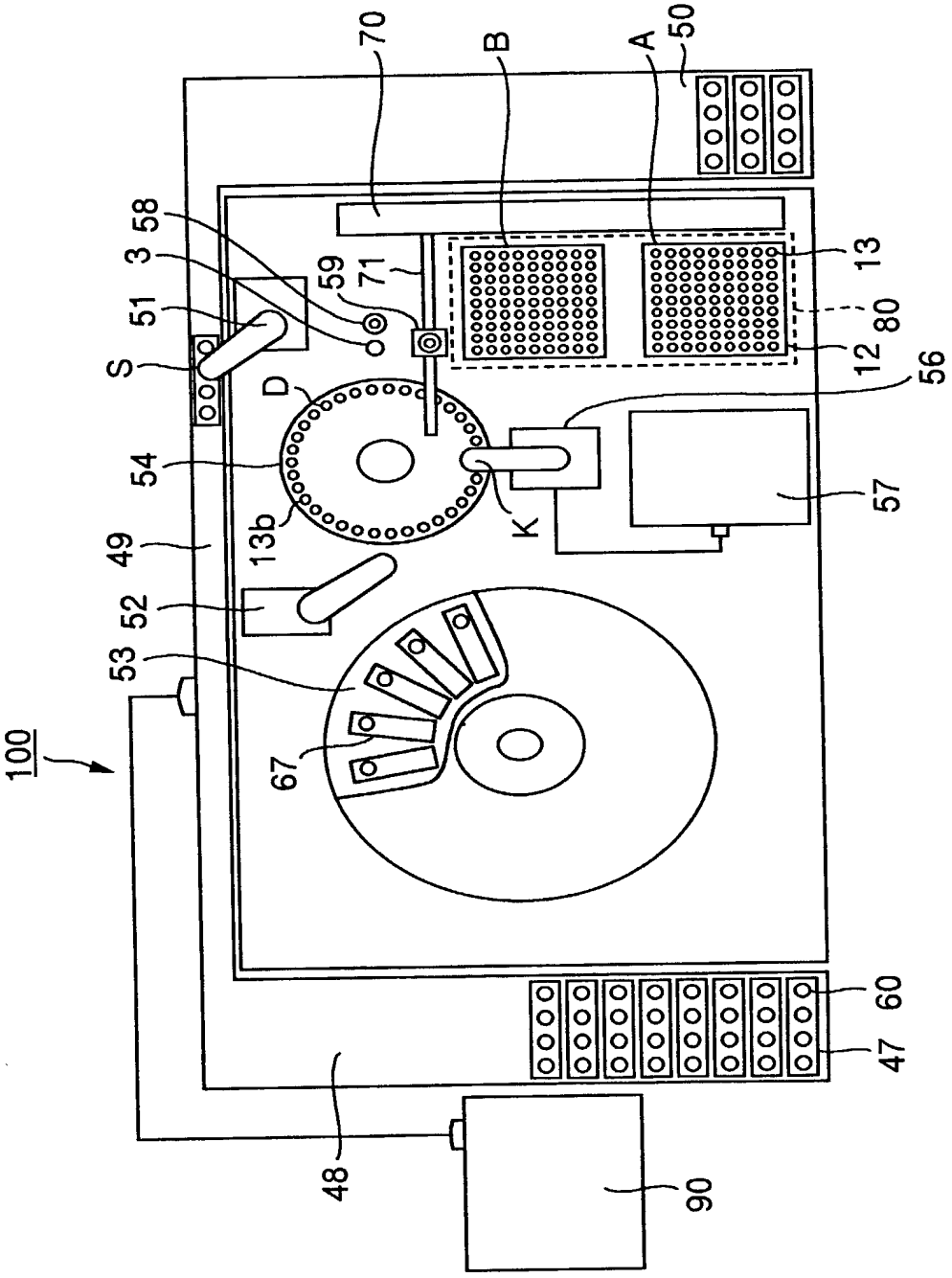
lowering said lift, said uppermost part rack separated from the other part racks, from said rack separation station to said part take-out station.

16. The automatic analyzer according to Claim 15, characterized by further comprising a transporting device that takes out a disposable part from the part rack on said part take-out station and transports this part to a predetermined position, and in that each part rack holding said nozzle tips also holds disposable reaction containers, and said transporting device that performs an operation of transporting a nozzle tip on said part rack to a position at which an unused nozzle tip is installed in a sampling device and an operation of transporting a reaction container on said part rack to a reaction part in which a sample and a reagent are allowed to react with each other.

ABSTRACT

An automatic analyzer, comprising disposable parts such as large quantities of nozzle tips and reaction containers for use in sample analysis inspection, wherein the part rack (12) holding unused parts is raised from a lowest position to a rack separation station (A) by a lift for supply (14) and separated so that only the uppermost stacked part rack can remain on the rack separation station, the separated part rack is moved to a part take-out station (B) where parts on the part rack are taken out one by one from a movable holding part (59), and, by opening the floor part of the part take-out station (B) after part consumption, the used part rack is allowed to fall down and recovered on the lift (84) of a recovery lifter (15), whereby the supply of an unused part rack on which unused parts are loaded and the recovery of a used part rack can be performed with a compact system configuration.

FIG.1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70
B
A
50
58
3
59
71
13
51
80
S
12
D
56
54
K
57
13b
49
52
53
67
60
47
48
90

FIG.2

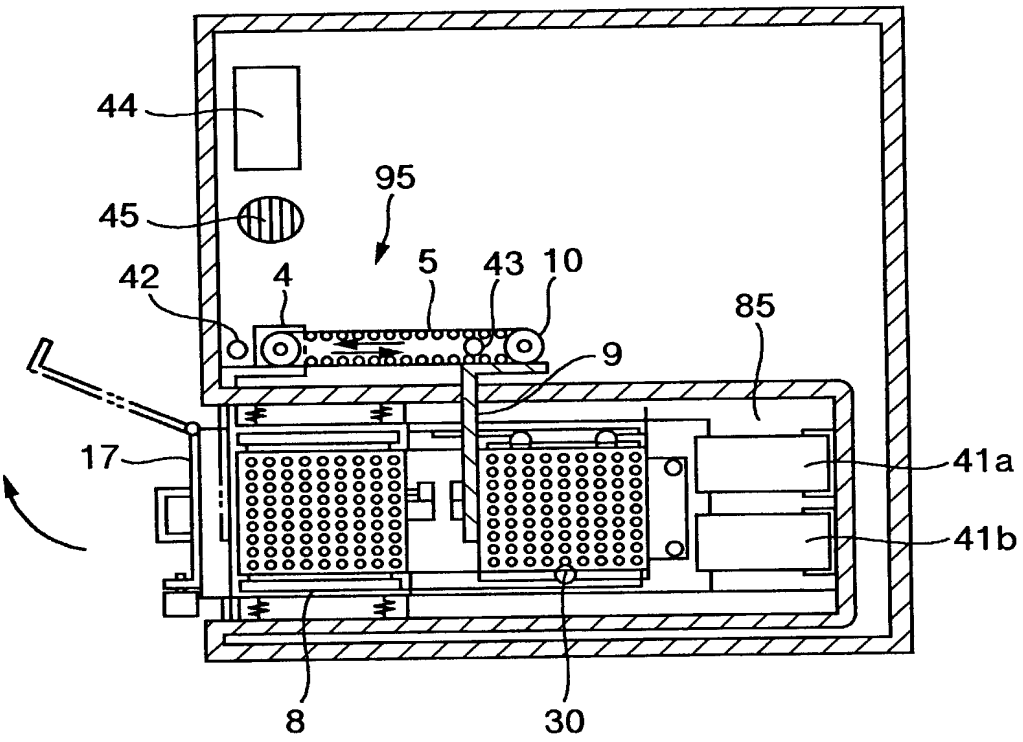
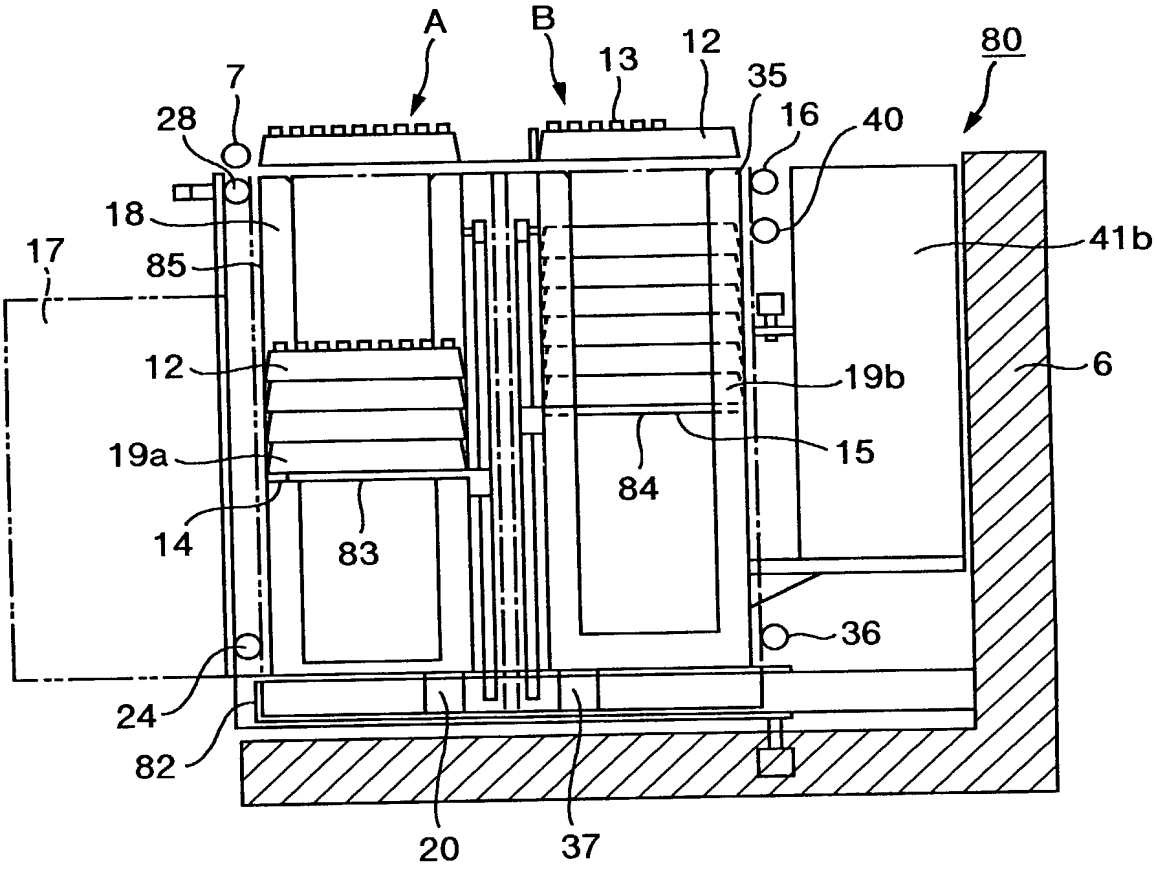


FIG.3


A
B
13
12
35
80
7
28
16
40
18
41b
17
85
12
19b
6
19a
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84
14
83
36
24
82
20
37

FIG.4

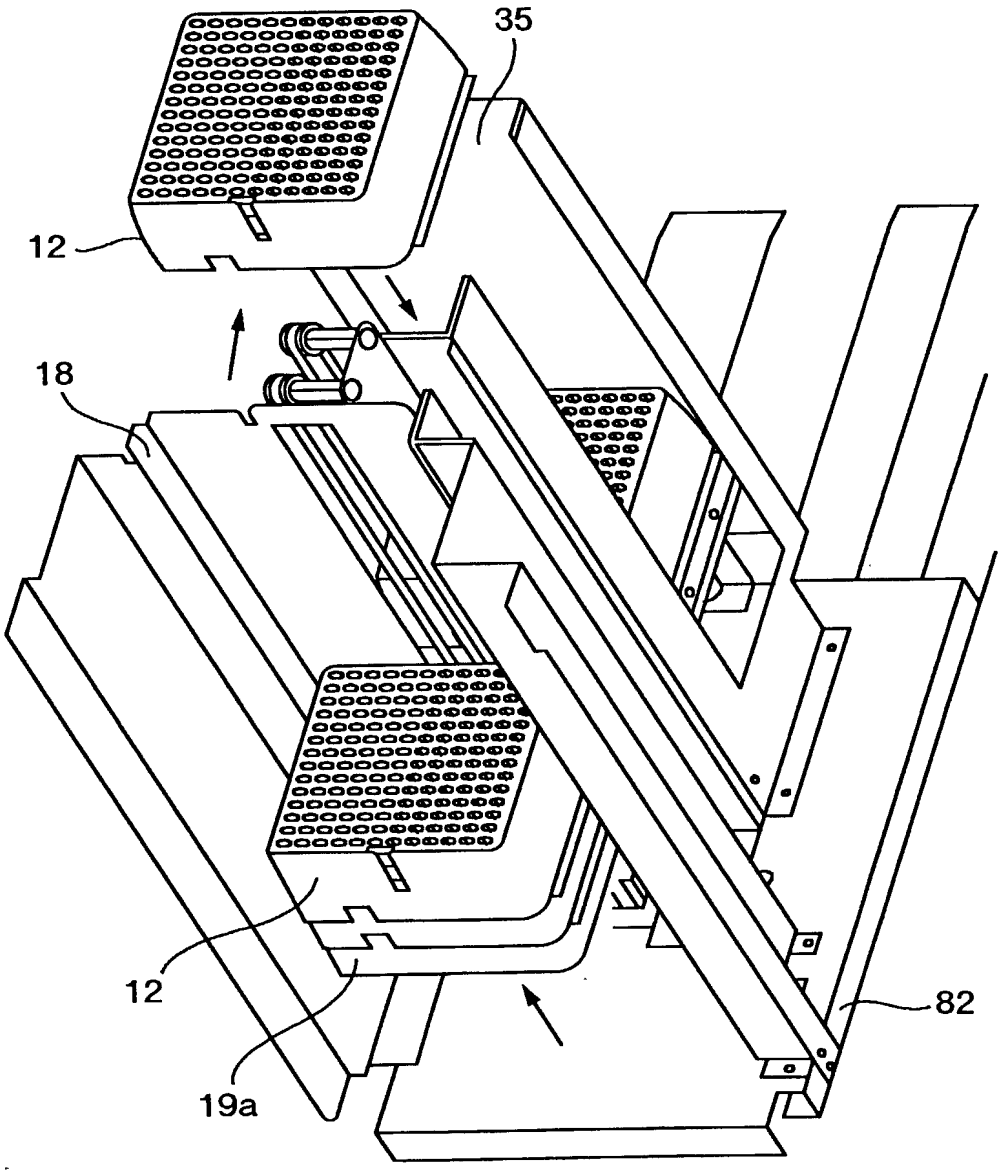


FIG.5

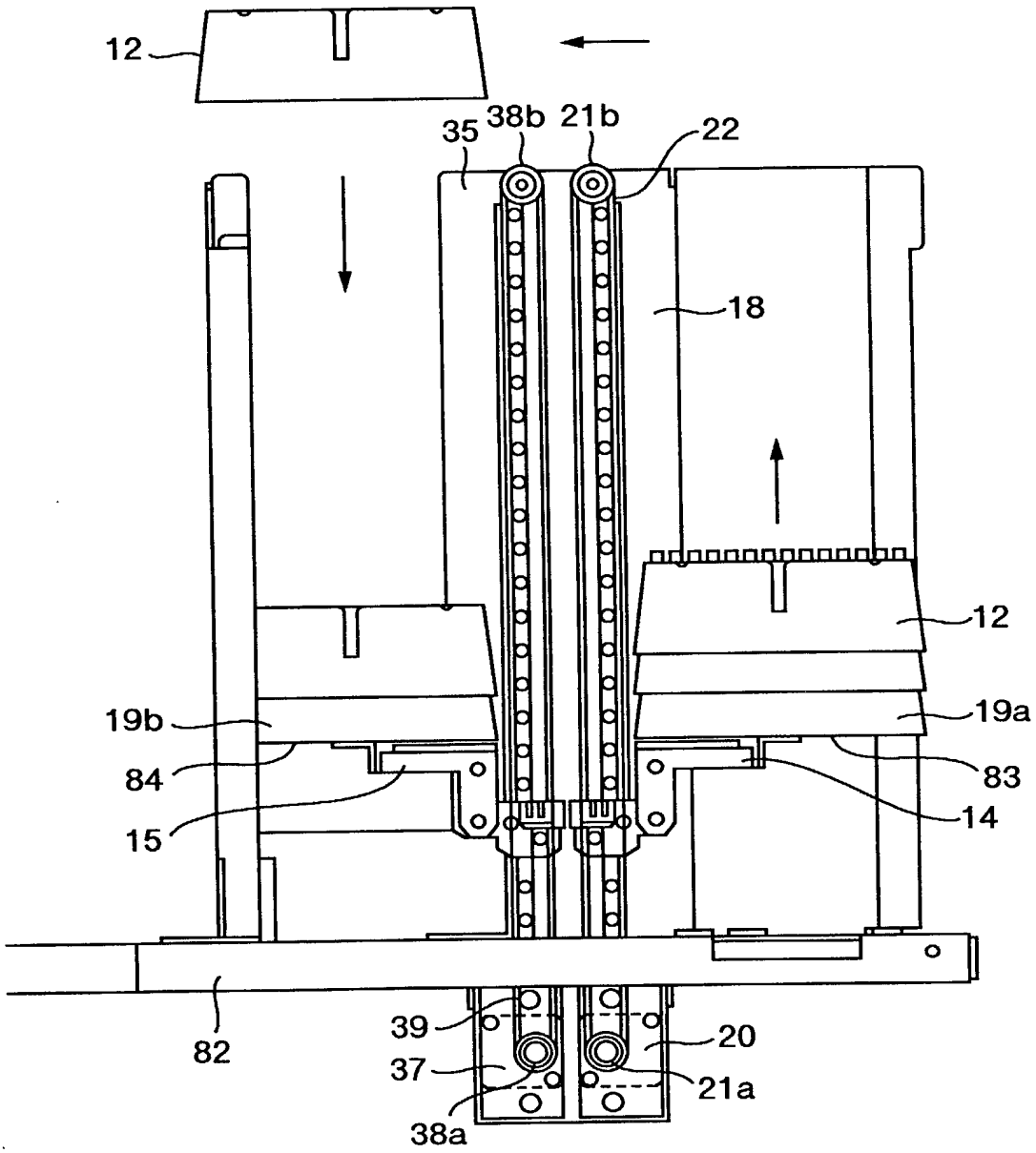


FIG.6

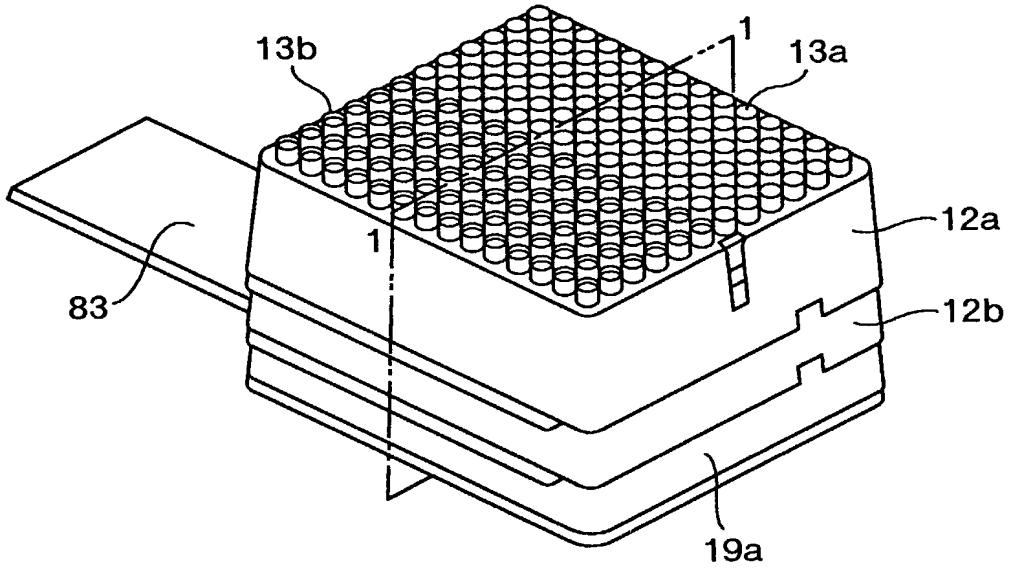


FIG.7

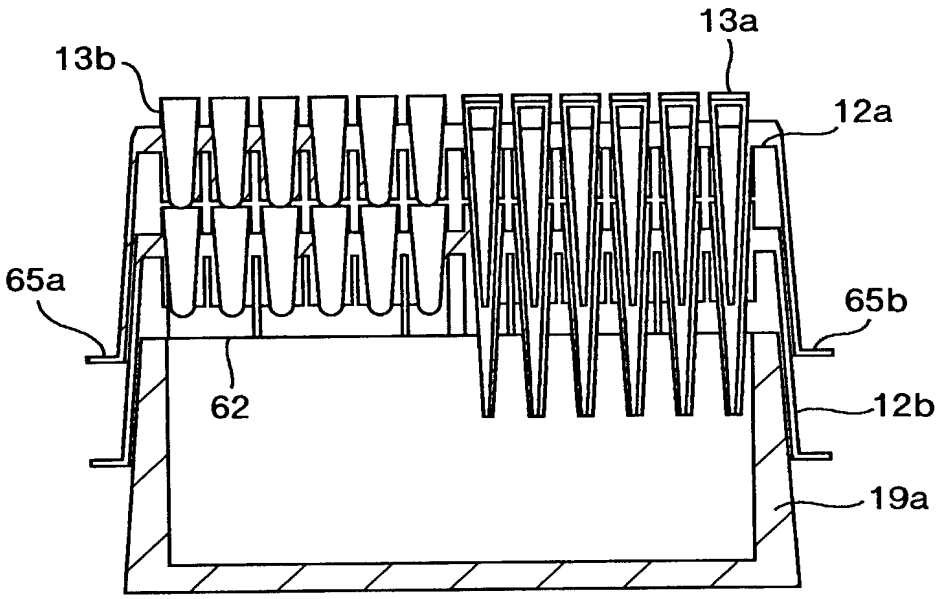


FIG.8

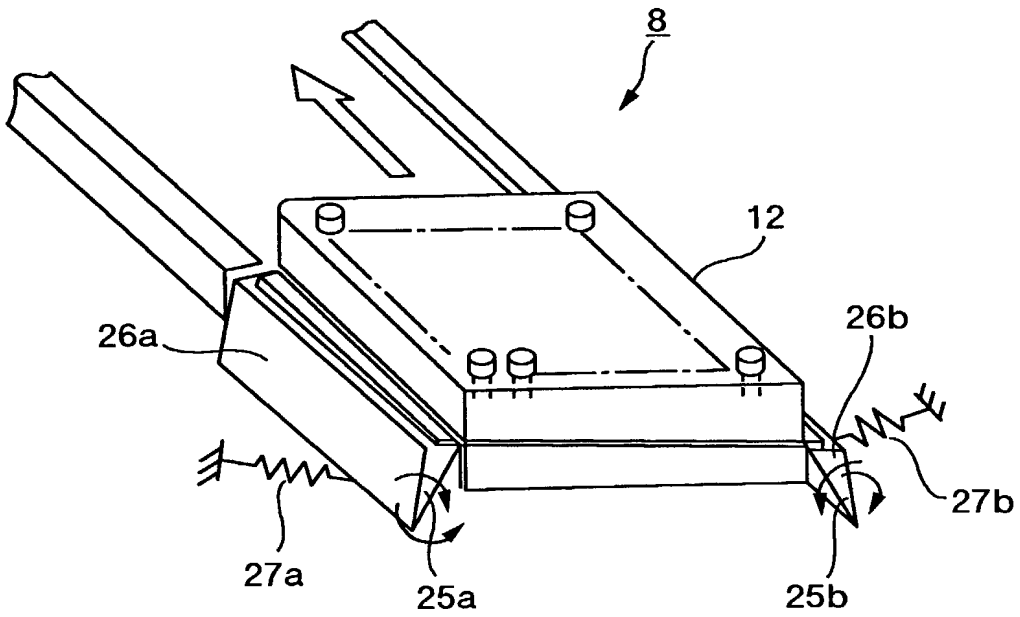


FIG.9

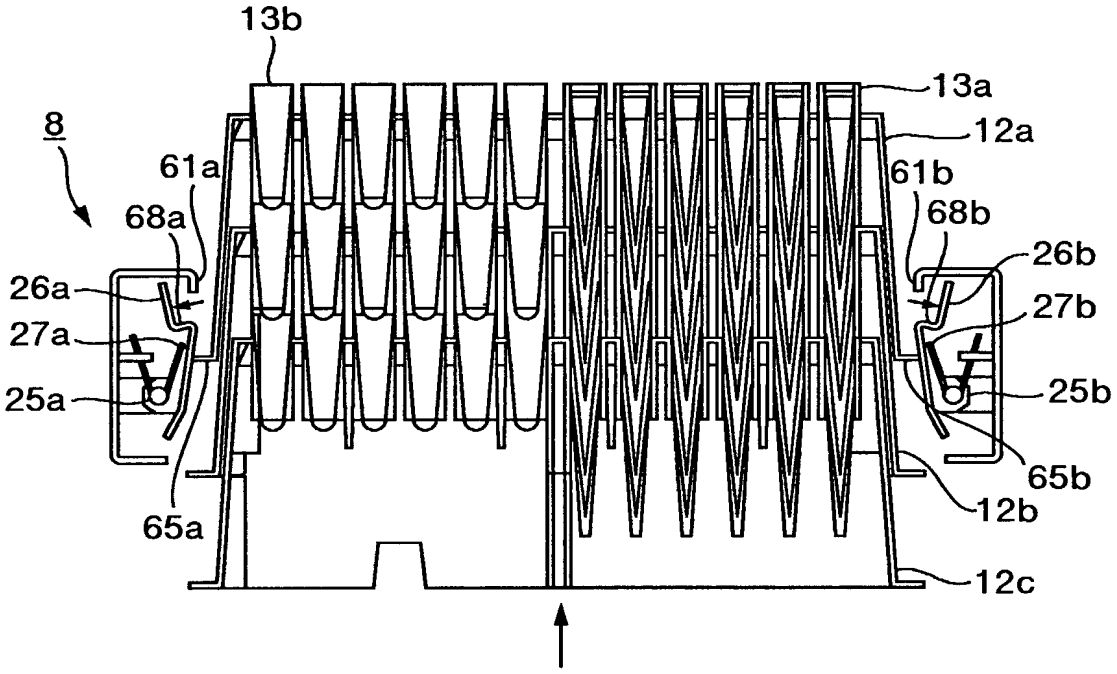

13b
13a
8
12a
61a
61b
68a
68b
26b
26a
27b
27a
25b
25a
65b
12b
65a
12c

FIG.10

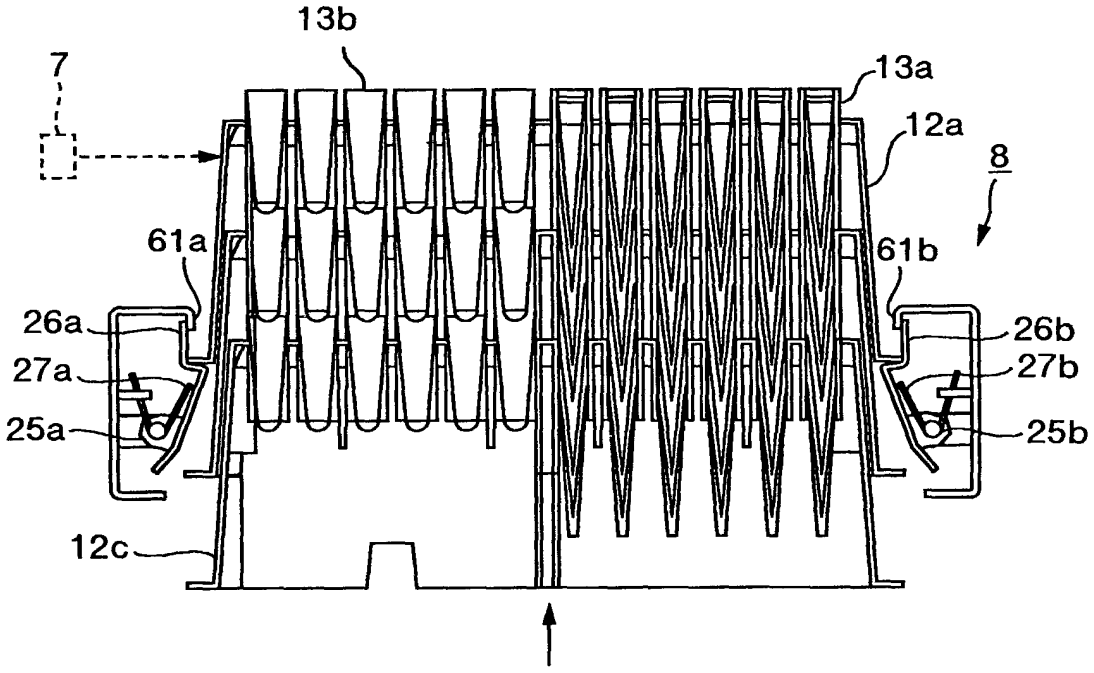


FIG.11

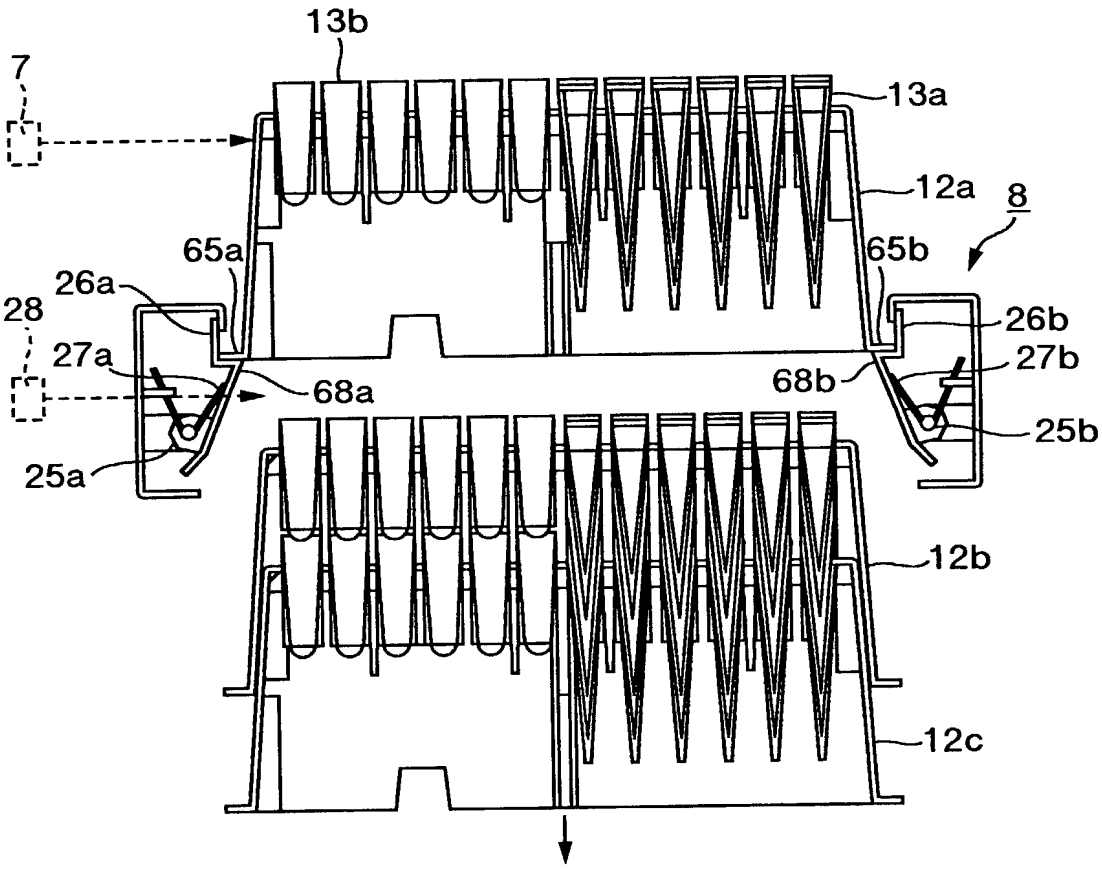


FIG.12

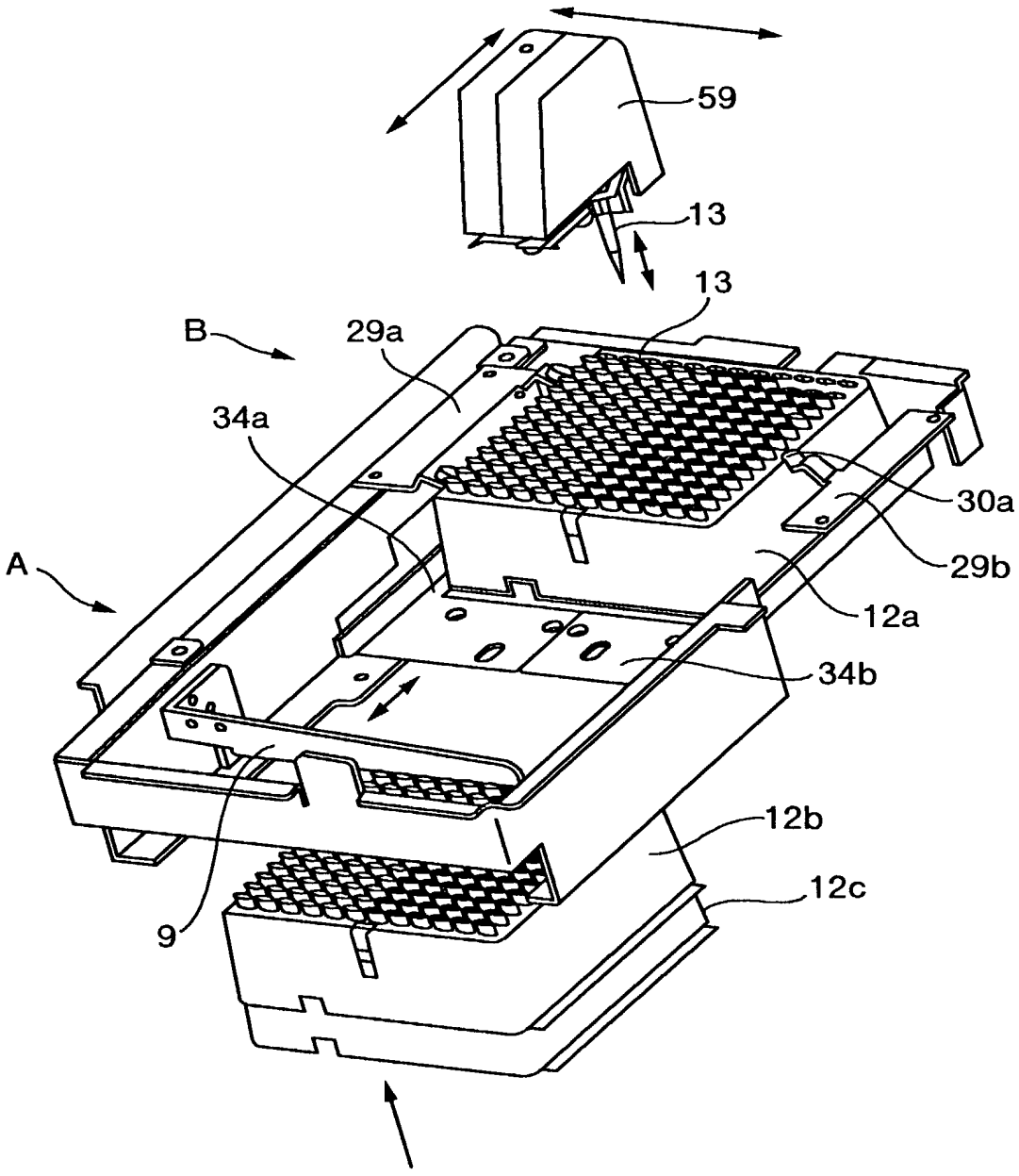


FIG.13

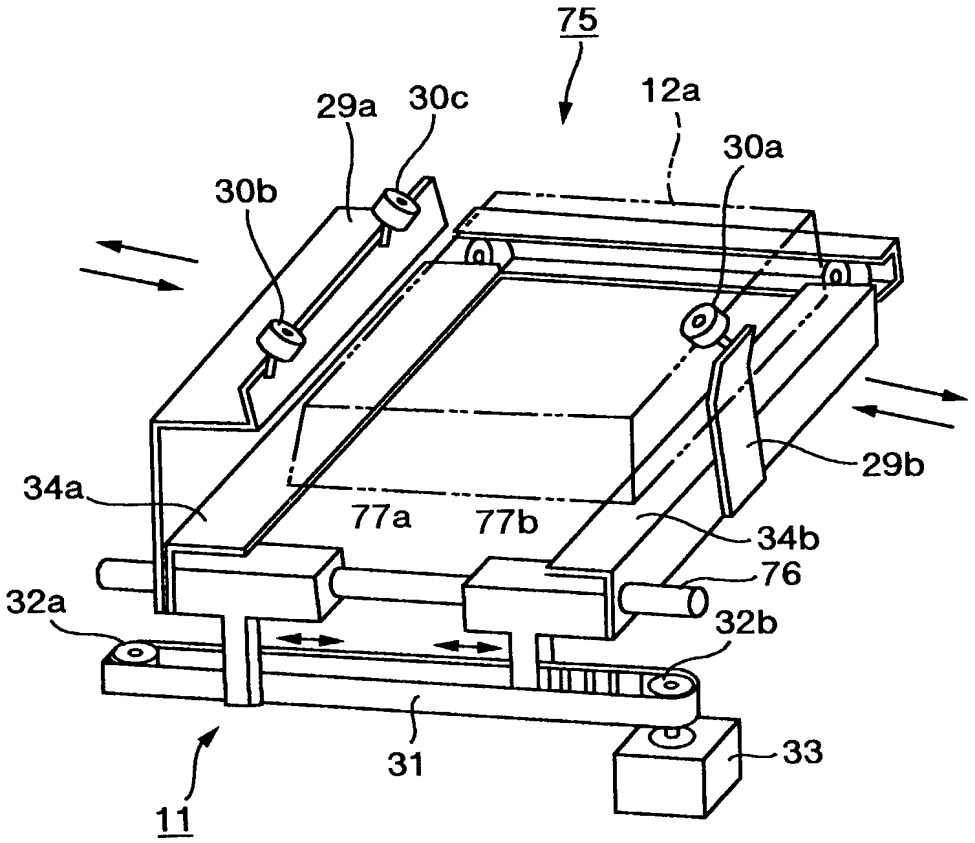


FIG.14

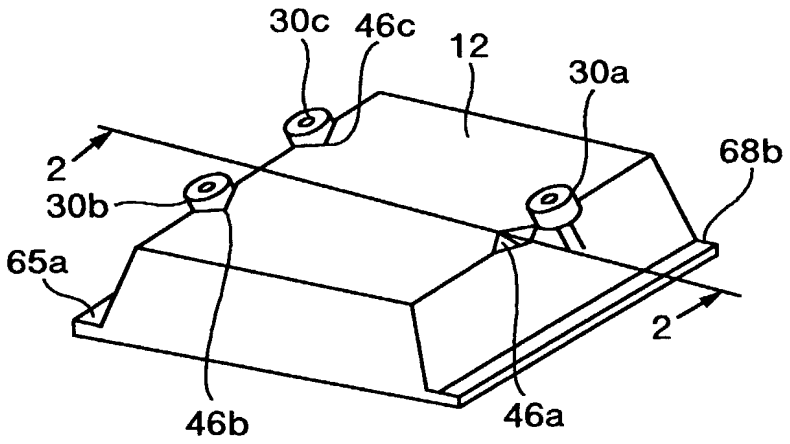
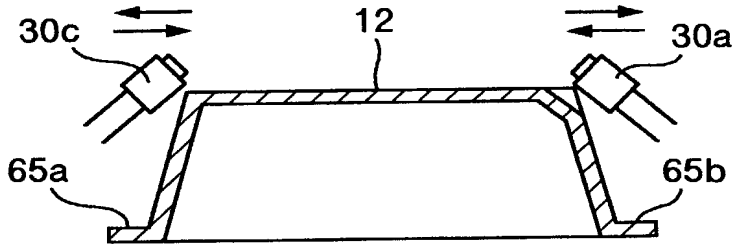


FIG.15



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Declaration and Power of Attorney For Patent Application

特許出願宣言書及び委任状

Japanese Language Declaration

日本語宣言書

下記の氏名の発明者として、私は以下の通り宣言します。

As a below named inventor, I hereby declare that:

私の住所、私書箱、国籍は下記の私の氏名の後に記載された通りです。

My residence, post office address and citizenship are as stated next to my name.

下記の名称の発明に関して請求範囲に記載され、特許出願している発明内容について、私が最初かつ唯一の発明者（下記の氏名が一つの場合）もしくは最初かつ共同発明者であると（下記の名称が複数の場合）信じています。

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

AUTOMATIC ANALYZER AND PART FEEDING DEVICE USED FOR THE ANALYZER

上記発明の明細書（下記の欄で×印がついていない場合は、本書に添付）は、

The specification of which is attached hereto unless the following box is checked:

☐ __月__日に提出され、米国出願番号または特許協定条約国際出願番号を__________とし、(該当する場合) __________に訂正されました。

☒ was filed on March 15, 2000 as United States Application Number or PCT International Application Number PCT/JP00/01574 and was amended on __________ (if applicable).

私は、特許請求範囲を含む上記訂正後の明細書を検討し、内容を理解していることをここに表明します。

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

私は、連邦規則法典第３７編第１条５６項に定義されるとおり、特許資格の有無について重要な情報を開示する義務があることを認めます。

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

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私は、米国法典第３５編１１９条 (a) - (d) 項又は３６５条(b) 項に基き下記の、米国以外の国の少なくとも一カ国を指定している特許協力条約３６５ (a) 項に基ずく国際出願、又は外国での特許出願もしくは発明者証の出願についての外国優先権をここに主張するとともに、優先権を主張している、本出願の前に出願された特許または発明者証の外国出願を以下に、枠内をマークすることで、示している。

I hereby claim foreign priority under Title 35, United States Code, Section 119 (a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)
外国での先行出願

(Number) (番号)	(Country) (国名)	(Day/Month/Year Filed) (出願年月日)	Priority Not Claimed 優先権主張なし
			☐
			☐

私は、第３５編米国法典１１９条 (e) 項に基いて下記の米国特許出願規定に記載された権利をここに主張いたします。

I hereby claim the benefit under Title 35, United States Code, Section 119(e) of any United States provisional application(s) listed below.

(Application No.) (出願番号)	(Filing Date) (出願日)	(Application No) (出願番号)	(Filing Date) (出願日)

私は、下記の米国法典第３５編１２０条に基いて下記の米国特許出願に記載された権利、又は米国を指定している特許協力条約３６５条 (c) に基ずく権利をここに主張します。また、本出願の各請求範囲の内容が米国法典第３５編１１２条第１項又は特許協力条約で規定された方法で先行する米国特許出願に開示されていない限り、その先行米国出願書提出日以降で本出願書の日本国内または特許協力条約国際提出日までの期間中に入手された、連邦規則法典第３７編１条５６項で定義された特許資格の有無に関する重要な情報について開示義務があることを認識しています。

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s), or 365(c) of any PCT international application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code Section 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of application.

(Application No) (出願番号)	(Filing Date) (出願日)	(Status. Patented, Pending, Abandoned) (現況：特許許可済、係属中、放棄済)
(Application No.) (出願番号)	(Filing Date) (出願日)	(Status: Patented, Pending, Abandoned) (現況：特許許可済、係属中、放棄済)

私は、私自身の知識に基ずいて本宣言書中で私が行なう表明が真実であり、かつ私の入手した情報と私の信じるところに基ずく表明が全て真実であると信じていること、さらに故意になされた虚偽の表明及びそれと同等の行為は米国法典第１８編第１００１条に基ずき、罰金または拘禁、もしくはその両方により処罰されること、そしてそのような故意による虚偽の声明を行なえば、出願した、又は既に許可された特許の有効性が失われることを認識し、よってここに上記のごとく宣誓を致します。

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Japanese Language Declaration
(日本語宣言書)

委任状： 私は下記の発明者として、本出願に関する一切の手続きを米特許商標局に対して遂行する弁理士または代理人として、下記の者を指名いたします。（弁護士、または代理人の氏名及び登録番号を明記のこと）	(6) POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith (list name and registration number) John R. Mattingly, Reg. No.30,293; Daniel J. Stanger, Reg No.32,846; Shrinath Malur, Reg No 34,663; Gene W. Stockman, Reg. No 21,021; Jeffrey M. Ketchum, Reg. No 31,174; and Scott W. Brickner, Reg No.34,553.
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直接電話連絡先：（氏名及び電話番号）	Direct Telephone Calls to: (*name and telephone number*) Telephone: (703) 684-1120 Fax: (703) 684-1157

唯一または第一発明者 1-00	Full name of sole or first inventor Hidetoshi SUGIYAMA
発明者の署名 日付	Inventor's signature Date Hidetoshi Sugiyama 02/14/2002
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国籍	Citizenship Japan
私書箱	Post Office Address c/o Hitachi, Ltd., Intellectual Property Group New Marunouchi Bldg. 5-1, Marunouchi 1-chome, Chiyoda-ku, Tokyo 100-8220, Japan

（第二以降の共同発明者についても同様に記載し、署名をすること）

(Supply similar information and signature for second and subsequent joint inventors.)

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第二共同発明者	3-00 Full name of second joint inventor, if any Katsuaki TAKAHASHI
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第四共同発明者	Full name of fourth joint inventor, if any
第四共同発明者の署名 日付	Fourth inventor's signature Date
住所	Residence
国籍	Citizenship
私書箱	Post Office Address
第五共同発明者	Full name of fifth joint inventor, if any
第五共同発明者の署名 日付	Fifth inventor's signature Date
住所	Residence
国籍	Citizenship
私書箱	Post Office Address